1 Book reviews

Schur parameters, factorization and dilation problems
T. Constantinescu
Operator Theory Advances and Applications, 82, Birkhäuser Verlag, Basel, Boston, Berlin, 1996, ISBN 3-7643-5285-X, ix+253 pages, Hardcover DM148

This book is a thoroughly reworked version of the lecture notes *Schur's algorithm and several applications* which were published by Longman in 1992. The main contents is the same but the ideas are much better elaborated.
The main tool is the Schur parametrization of positive block matrices. This is developed, using an interplay of operator theory (in particular the theory of intertwining dilations) and linear algebra (Cholesky factorization). But also complex analysis takes an important place because these parameters are of course related to Schur functions, which are contractions of the unit disk.
The results are taken far beyond the original treatment of the continued fraction algorithm given by Schur in 1917 and the scalar generalizations that were developed from it. Its resurection in the sixties by mathematicians and engineers working in time series analysis, in transmission-line theory and seismic signal processing also lead to the discovery of the intimate connection with Szegő's theory of orthogonal polynomials on the unit circle. When applications were developed for vector valued signals, generalizations to matrix and operator theory started to emerge. Such problems gave rise to moment problems for matrix or operator valued mesures, to tangential interpolation problems and Nudelman interpolation problems and more recently to time variant versions of these.
This operator approach is the starting point of the book, but gradually applications are introduced. Lattice filters, scattering theory, differential equations, discrete transmission-lines, factorization of matrices with low displacement rank, spectral factorization, realization theory, orthogonal polynomials, moment problems, maximum entropy, linear prediction of stationary and of time variant signals, they all take the floor in turn and gradually their interplay becomes clear.
Most of these ideas have been around in the literature for a couple of years. In the last two chapters however, more recent developments are presented. One of them deals with general completion problems for matrices which generalize the classical problems in the sense that the specified elements are not located on a band near the main diagonal, but they can be specified in a more random pattern, elements from graph theory come to a rescue and the link with Schur parameters will come as a surprise to many who were not familiar with these problems before. The last chapter deals with the problem of finding the solution of such a completion problem whose determinant is maximal.
This book is an in principle self-contained treatment of these subjects, but a good background in operator theory is most welcome. It will certainly fascinate the reader who is interested in some or all of these problems. That might be engineers working in the applications or pure mathematicians. This text gives the floor to an intriguing interplay of what mathematics is all about: a joint effort of many different fields of theoretical and computational mathematics to solve beautiful theoretical as well as practical engineering problems.

A. Bultheel

Fourier transforms: an introduction for engineers
Robert M. Gray and Joseph W. Goodman
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Fourier analysis is an indispensable tool for every engineer, in particular for every electrical engineer. Fourier analysis is also a beautiful piece of mathematics which involves nontrivial notions like Lebesgue integration, L^p spaces, generalized functions etc. It is therefore not an easy task to give a careful treatment of this subject for engineering students without frightening them by getting too much involved in abstract mathematics. However, this is precisely what this textbook is aiming at and in my opinion with a great deal of success. The only prerequisites are basic cal-